

CENTRAL VALLEY RIPARIAN MAPPING PROJECT

INTERPRETATION AND MAPPING SYSTEMS

June 1979

STATE OF CALIFORNIA

RESOURCES AGENCY - DEPARTMENT OF FISH AND GAME

SUMMARY OF CLASSIFICATION CODES

1. MAJOR CATEGORIES AND SUBCATEGORIES

- R1 LARGE WOODY VEGETATION
- R1v VALLEY OAK WOODLANDS
- R2 LOW WOODY VEGETATION
- R3 HERBACEOUS VEGETATION
- R3p HERBACEOUS PERENNIAL SEEPS AND SPRINGS
- M MARSH
- S SAND AND GRAVEL BARS
- A AGRICULTURAL LAND
- U URBAN LAND

2. MODIFIERS

- c CHANNELIZED
- d DISTURBED
- i INTERMITTENT

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June, 1979

For:

The State of California
Resources Agency
Department of Fish and Game

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This mapping project is an element of the overall riparian study and will contribute to development of study recommendations for resource protective actions. In addition to the development of a riparian protection strategy, the maps will provide a record of the resource as it exists today. From this data base we will be able to determine change in the riparian resource in the years to come. The maps will also be used to determine and analyze potential impacts of development upon the resource on a day to day basis.

The mapping project was carried out by two mapping teams comprised of graduate and undergraduate students from California State Universities at Chico and Fresno. The initial concept of the project was developed by Bob McGill, Senior Land Use Analyst with the Northern District, Department of Water Resources. His success in using 35mm color slides in mapping riparian vegetation in his district as part of DWR's ongoing land use mapping project prompted DFG investigation and implementation of this technique.

Relation to Other Mapping Efforts

While other mapping projects have mapped portions of the Valley's riparian resource, this is the only study that provides complete coverage of the entire

I. INTRODUCTION

Project Background.

Legislation enacted in 1978 appropriated \$150,000 to the Department of Fish and Game for a study of the riparian resource of California's Central Valley and desert. This legislation was the result of efforts of organized conservation groups and concerned individuals for legislative action to improve protection of the State riparian environment. These efforts were supported by the Department of Fish and Game and other governmental agencies concerned with riparian resource protection.

This mapping project is an element of the overall riparian study and will contribute to development of study recommendations for resource protective actions. In addition to the development of a riparian protection strategy, the maps will provide a record of the resource as it exists today. From this data base we will be able to determine change in the riparian resource in the years to come. The maps will also be used to determine and analyze potential impacts of development upon the resource on a day to day basis.

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Relation to Other Mapping Efforts.

While other mapping projects have mapped portions of the Valley's riparian resource, this is the only study that provides complete coverage of the entire

Valley floor. A complete list of mapping efforts of other agencies will be presented in the Riparian Study Report to be completed in late 1980.

Project Objectives and Scope.

The Central Valley Riparian Mapping Project was intended to provide a set of base-line maps of existing riparian vegetation. This mapping project documents the extent and distribution of this resource in the Central Valley. The results of the riparian study will be incorporated into the Department of Fish and Game's Fish and Wildlife Plan and will help direct future riparian studies as well as funding for preservation and restoration programs.

The classification of riparian types was based on general vegetative structural types (physiognomy) which can be distinguished with relative ease from aerial photography. Classifications are general, and do not in themselves fully describe the ecological diversity of these complex habitat types. Their usefulness, therefore, must not be construed as a detailed characterization of this ecological system.

The mapping effort was conducted according to priorities dictated by available imagery and time (see Figure 1). First priority was assigned to areas of the Central Valley which are covered by Department of Water Resources aerial photography. Included in this area are valley floor and lower foothill areas of the Sierra Nevada and Coast Ranges. These first priority areas were mapped as described in this report. The second mapping priority included the major tributaries of the Central Valley rivers up to the upper limit of the Blue Oak-Digger Pine zone as described by A.W. Kuchler's "'Map of Native Vegetation of California'" (approximately 2,500 feet elevation). Second priority areas were not mapped, due to the lack of adequate photographic coverage. The

PRIORITY MAPPING AREAS



riparian vegetation of these areas is described in a separate report from data collected by the mapping teams. (Note: The Sacramento Delta region is not included in this mapping effort because detailed mapping has already been completed by the U.S. Army Corps of Engineers.)

II. MATERIALS

Imagery

Aerial photography served as the data base for the mapping process. Department of Water Resources (DWR) 35 mm color slides were used as the major information source for the Central Valley mapping area. Figure 2 shows the area covered by the DWR imagery. These photos were obtained at low altitude (ca. 5,000 feet) and provide detailed coverage for much of the study area. The large scale of this true color imagery made interpretation of vegetation types relatively simple.

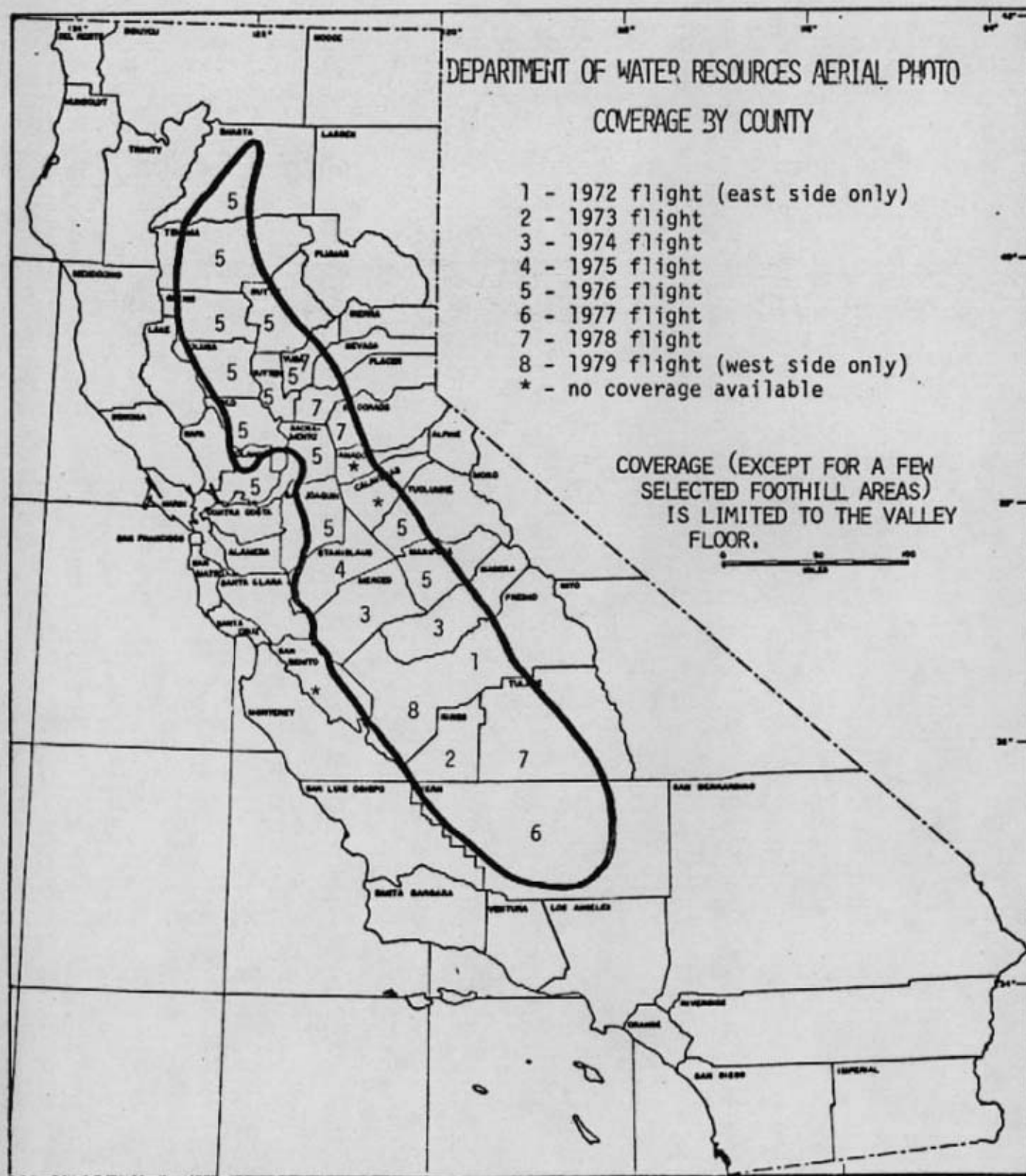
For those areas not covered by the Department of Water Resources photography, high altitude, U-2, false color infrared photography was used. Figure 3 identifies areas covered by this imagery. Backup coverage was provided by standard panchromatic (black and white) 9x9 photography, which was only used when 35 mm or U-2 imagery was not available.

Mapping Materials

Materials used for the actual mapping included base maps, reference maps, and drafting supplies. Base maps were fade-out blue copies (or mylar overlayed on Cronulflex copies) of U.S.G.S. 7.5 minute topographic map quadrangles. Topographic features which were visible on the base maps helped in placing the map characters in the appropriate position. These features did not reproduce on later copies, thus presenting only the mapped riparian information.

The reference maps used to assist in the riparian mapping process included the DWR Land Use Series, standard U.S.G.S. 7.5 minute topographic quadrangles, and copies of other riparian and river mapping efforts (e.g., DWR's Sacramento River Atlas.)

FIGURE 2



AVAILABLE U-2 COVERAGE OF THE CENTRAL VALLEY



Drafting materials consisted of ultra-fine (.5-.3 mm) soft lead drafting pencils for transfer work, 3/16 Stadler (16S Pickett) templates for lettering, and other drafting supplies (e.g., straight edge, erasers, etc.)

jection systems were devised for both the Department of Water Resources 35 mm color slides and the high altitude false-color infrared photography.

In most cases, information from the 35 mm slides was transferred to the appropriate base maps through the use of a system which projected the image to the bottom of the map through a glass table. Figure 4 shows a schematic diagram of this system. A Kodak Ektographic high light intensity slide projector (Model AF-2) with a 3 inch ($f:3.5$) close-up lense was used to project the slides. The image was reflected up through the glass table-top by means of a mirror which was mounted at a 45° angle. Slides were reversed when placed in the projector to allow for the reversal of the reflected image. Scale was adjusted either by moving the mirror toward or away from the projector (for major adjustment), or through the use of the projector's focus mechanism (for minor adjustment).

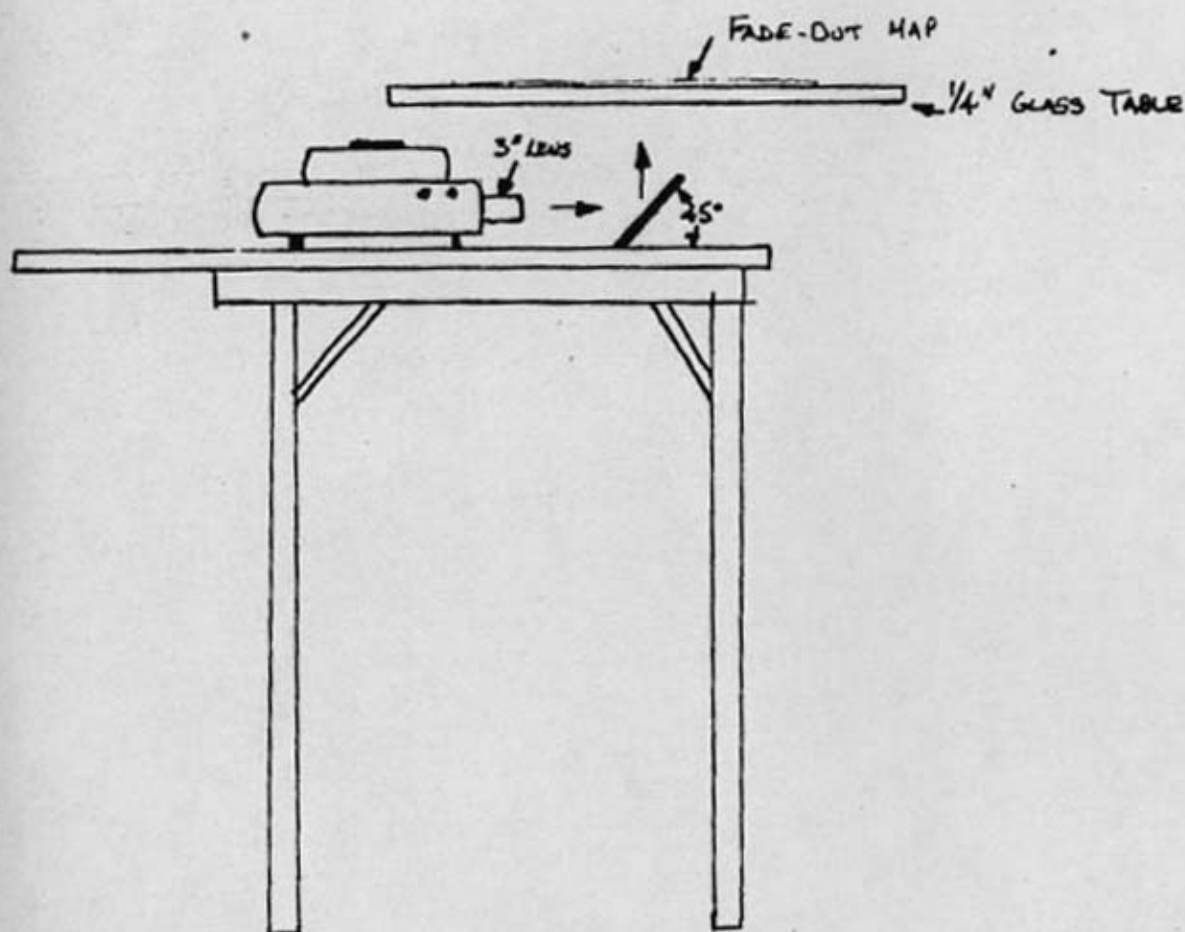
The CSU, Fresno mapping team also employed a system whereby a photographic image was projected onto a screen in front of a mapper. The mapper would then transfer riparian data free-hand onto the appropriate base map.

The high altitude imagery was interpreted on a military surplus Variscan Viewer (Nuclear Research Instruments, Inc.) which was designed specifically for use with this photographic format. This machine projects, magnifies and reflects the transparent image to a large vertical screen from which interpretations were made.

Cartographic Representation

Cartographic representation of riparian vegetation types was accomplished by outlining habitat areas and labeling these with a letter or letter-number classification code. Where vegetation strips were too narrow to outline (i.e., such as along a narrow stream or canal less than 100 feet wide), the vegetation was indicated by a single solid line.

FIGURE 4. Schematic of Transfer System



- SCALE ADJUSTS BY MOVING THE MIRROR FORWARD OR BACKWARD OR (FOR MINOR ADJUSTMENTS) THROUGH THE USE OF THE PROJECTOR'S FOCUS MECHANISM.
- THE IMAGE CAN BE PROJECTED AT THE SAME SCALE AS THE BASE MAP, MAKING TRANSFER WORK ACCURATE AND EFFICIENT.
- SLIDES MUST BE REVERSED TO COMPENSATE FOR THE REFLECTED IMAGE.

Letter codes were placed within the boundary of the outlined area when space permitted; where space was limited, the letter code was placed outside and an arrow was drawn to the center of the area. Where the vegetation type was indicated by a single line, an arrow was drawn to that line. Where more than one vegetation type occurred on a narrow (single line) strip, the end of one type was indicated by a short perpendicular line. When a single line intercepted a polygon or another single line, a label was placed on each line segment. In some cases a single line served both as a narrow vegetation band and as a border between two differing types. Examples of this cartographic representation appear in Figure 5.

Mapping Constraints

The following criteria were used as the basis for mapping:

1. Areas with native or "wild" (non-agricultural) riparian vegetation which could be polygoned (outlined) were always mapped.
2. Canals, discontinuous streams, or wet areas which appeared (from the imagery) to be dependent upon an artificial water source and devoid of woody riparian vegetation were not mapped.
3. Agricultural and urban areas were mapped only when they appeared as islands partially or completely surrounded by riparian vegetation.

FIGURE 5. EXAMPLES OF CARTOGRAPHIC REPRESENTATION

A. DELINIATING HABITAT AREAS.

BROAD AREAS



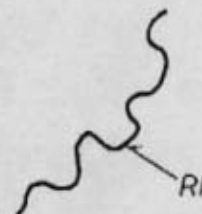
MODERATELY BROAD AREAS



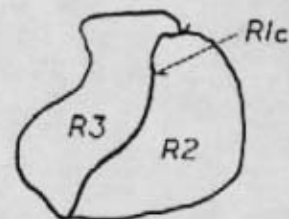
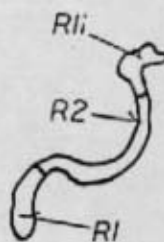
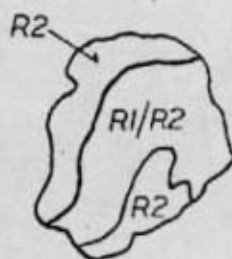
NARROW AREAS



B. LABELING.



C. LABELING WITH MORE THAN ONE CATEGORY.



III. CLASSIFICATION SYSTEM

The classification system used in the mapping project is based on general structural differences in vegetation which readily can be discerned from aerial photography. This system cannot be construed to represent the ecological diversity that one may find upon ground inspection of the riparian habitat, as it only indicates general distribution of major vegetation types. }

The habitat types were divided into six riparian or riparian associated categories, two sub-categories (for minor types occurring as part of major categories), and two non-riparian categories (used where non-riparian lands are surrounded by riparian habitat). In addition, three modifying characters were used to indicate special circumstances under which riparian habitats occur.

A "hybrid" system was devised to describe those areas which appear to have a mixture of more than one riparian type. In such cases, the codes of the two most predominant vegetation types were indicated.

CLASSIFICATION CODES

R1 - Large Woody Vegetation.

Large Woody Vegetation refers to the older, well established riparian forests which are represented by tall (over 12 meters), woody vegetation. In the Central Valley these areas are usually dominated by Cottonwood (Populus fremontii), Black Walnut (Juglans hindsii), Western Sycamore (Platanus racemosa), Oregon Ash (Fraxinus latifolias), and Willow (Salix goodingii var. variabilis). Accompanying these species is usually a dense understory of shrubs and vines including Wild Grape (Vitis californicus), Blackberry (Rubus spp.), and Mugwort (Artemisia douglassiana).

This vegetation type may cover large areas along broad undisturbed flood plains or very narrow (sometimes discontinuous) strips where human land use practices have encroached.

R1 - Large Woody Vegetation. Note dense mature stands of large trees with shrubby understory.



The R1 category may be discerned in true color aerial photography on the basis of distinct color or mottled color combinations, the evident pattern of tree crowns, relative topographic location, and occasionally by the occurrence of tree shadows.

The color of the R1 category is typically much lighter (at times almost yellow-green) than the R1v category (the only other tall tree category). R1 often shows a color or tonal mottling which results from the occurrence of numerous tree and shrub species.

The crowns of individual large trees are usually evident when surrounded by different species. However, a dense, even stand of large trees (usually of tall Cottonwoods) may appear homogeneous throughout; in such cases individual

tree crowns are less discernable. However, the occurrence of long shadows or a comparison with associated vegetation nearby usually is adequate to accurately identify the signature as R1. Where questions arose, ground truth was sought.

R1v - Valley Oak Woodland.

This subcategory of Large Woody Vegetation (R1) refers to the Valley Oak Woodland plant community. These are mature stands of well-spaced Valley Oak (Quercus lobata) without a well developed woody understory. Valley grassland species dominate the areas between trees. This vegetation type is generally associated with high terrace portions of lower elevation Central Valley rivers.

R1v may occur adjacent to other riparian types near streams, or as discontinuous isolated patches away from stream courses. Before extensive land clearing, these isolated patches would have been part of a larger woodland associated with the other riparian vegetation types.

This unique vegetation type usually can be discerned from R1 and R2 vegetation on the basis of its dark green color. In addition, rounded, well-separated crowns often can be identified in older stands. As Valley Oaks are large stately trees, shadows are also a good indicator of this vegetation type.

R1v - Valley Oak Woodland



R2 - Low Woody Vegetation

This category represents an early successional stage of riparian forest development. Trees are younger, lower (up to 12 m in height), and may occur with shrub species. Willows (Salix spp.) and young Cottonwoods usually dominate, although brush species occur in some areas.

There are several ways to recognize the R2 classification on aerial photographs. Interpretation characteristics include nearly consistent coloration, an even photographic texture, and the association of R2 with other habitat types. R2 is generally light green or gray green in color. It usually appears as a consistently dense, closely-spaced stand, although spottiness may occur. As an early successional type, R2 can be expected to occur along sand bars, receding oxbow lakes and sloughs, and in disturbed areas such as canals, levies, etc. It sometimes appears as an intermediate between open water (or sand bars) and the R1 habitat. Also, it may occur alone, especially along smaller streams in the lower foothills.

R2 - Low Woody Vegetation. Note lower shrub-like young Cottonwoods and Willows.



Transition from open water (foreground) to R1 (background).



R3 - Herbaceous Vegetation

Herbaceous Vegetation includes low (usually less than 1 m), introduced, and native (mostly annual but some perennial) herbaceous species. Occurrence may be natural (e.g., valley grassland plant community or perennially green herbaceous areas along streams) or as the result of severe disturbance (constituting an early successional stage).

Two types of riparian associated herbaceous vegetation were found on the aerial photographs. Valley grasslands are treeless, low in stature, and brown in color during the summer months. In agricultural areas of the Central Valley it almost exclusively is located within a riparian corridor (i.e., uncultivated streamside lands) and may be surrounded by other riparian types.

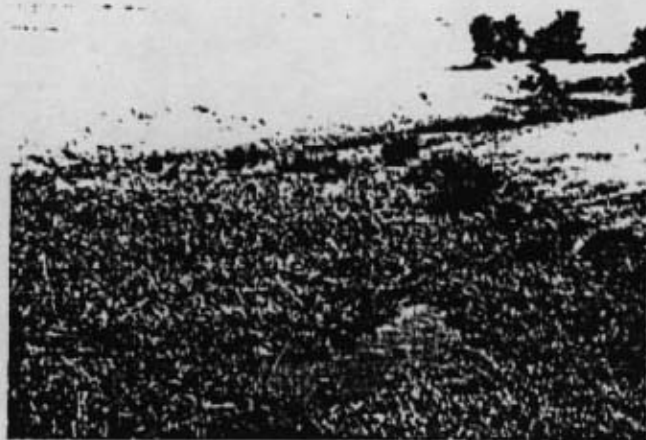
The other type of herbaceous riparian vegetation usually occurs along stream courses on valley rangeland. It is low in stature with little or no woody vegetation in evidence but is green during the summer months in contrast to the brown of the surrounding rangelands.

R3 - Herbaceous Vegetation

Valley Grassland Type



Perennial Stream-side Type



R3p - Perennial Seeps

This is a special subcategory of R3 referring to spring areas that are perennially green with herbaceous vegetation. This subcategory is not used for perennially green areas along streams and is differentiated by its patchiness and separation from streamside R3. Artificial seeps such as those associated with irrigation canals, wells or windmills were not included in this subcategory.

R3p - Perennial Seeps

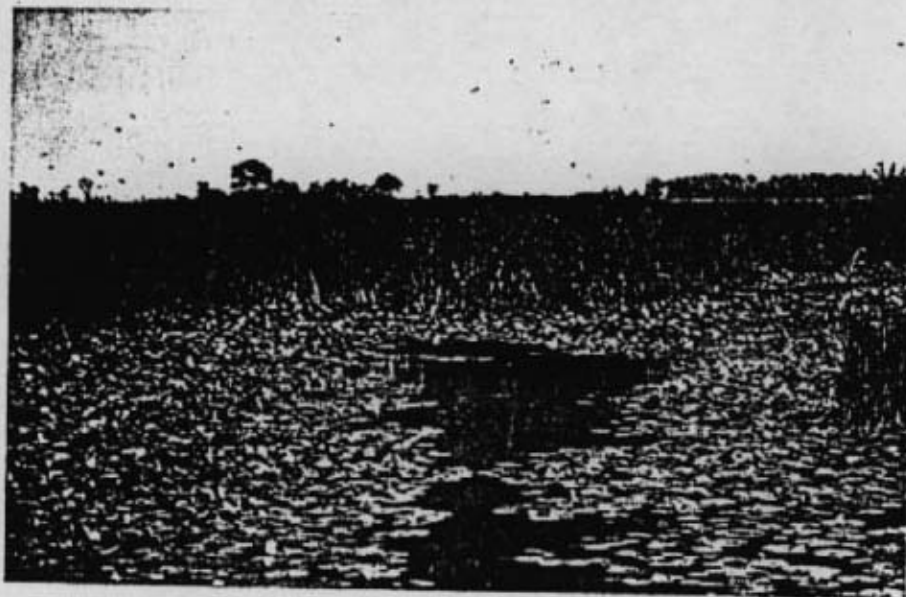


M - Marsh

The M classification category includes intermittent or perennially wet areas with emergent herbaceous vegetation. These areas are characterized by dense stands of tall grass-like plants such as Tules (Scirpus spp.), Cattail (Typha spp.), Sedges (Carex spp.), and Rushes (Juncus spp.). These plants are found in, and sometimes broken by, continuously moist areas of mud or standing or sluggishly moving shallow water. Marsh areas are commonly associated with rivers, streams, lakes, canals, or depressions (sinks).

Marshes can be distinguished on aerial photographs on the basis of color, pattern, location, and association with other habitat types. On the photos, marsh appears as a mixed light or dark green color. The arrangement of marsh species varies from highly mixed stands (seen as mottled shades of green on the aerial photographs) to homogeneous bands around open pools (which appear as concentric rings around the water area). Marshes are usually found adjacent to or along canals, streams, sinks, and sloughs. They often are found adjacent to Willows and herbaceous habitat types. Where marsh occurs within channelized streams, it is often indiscernible. Where marsh occurs with taller mature forests, it is difficult to recognize except in instances where it covers very large areas. Since marsh vegetation was mapped only when it was found in or adjacent to other riparian types, not all of the Central Valley marshland was mapped.

M - Marsh. Note open waters surrounded by emergent vegetation.



S - Sand and Gravel Bars.

Areas of sand and gravel or exposed rock are included in this mapping category. Vegetation is usually limited to very low Willows, Cottonwoods and intermittent herbaceous growth which is undiscernable from the aerial photographs. Usually Sand and Gravel Bars occur adjacent to a stream channel. Photographic signatures include white, gray and brown colors.

W - Open Water

The open water classification includes standing or moving open waterways which are significantly free of vegetation. Sometimes these areas were difficult to interpret (especially where there was standing water surrounded by tall, overhanging vegetation) as often this water displays a dull green hue which was similar to the surrounding vegetation. Interpretation indicators include a dull green color, flatness and a very smooth, even texture with occasional reflections evident on the aerial photographs. In other situations, (particularly with moving water) the color may be darker. Where white areas occur,

riffles or rapids may be present. Open water should be apparent in stream and river channels. In areas where water cannot be seen on the photographs (even though it may be present) it was not mapped. Only water associated with riparian vegetation was mapped. For example, most man-made canals and reservoirs in the Central Valley were not mapped when devoid of significant riparian vegetation.

.A - Agriculture

Agricultural lands which are partially or completely surrounded by riparian habitat are included in this category. All cultivated and recently cleared lands are included. Agricultural areas which are adjacent to, but not surrounded by riparian lands are not mapped.

U - Urban

The urban classification includes those built-up areas which are completely surrounded by riparian habitat. (In practice, this mapping unit is seldom used.) Any land cleared of its natural vegetation and put to industrial, commercial or residential use would fall into this category.

Modifiers

The following modifying codes are used to signify special circumstances under which riparian habitat might be found. Examples are illustrated in Appendix B.

c - channelized

This modifier is used where riparian vegetation exists along a water course which appears to have been modified by human activity to the point that natural stream contours are not visible.

d - disturbed

Areas of severe man-caused soil disturbance are included within this modifier. Dredger tailings and gravel mining operations are the most common examples. Numerous ponds are found in some of these areas. Ridges of un-vegetated gray rock occurring on the more recent sites indicate dredger tailings. At older locations, these ridges may be vegetated with a thin covering of herbaceous growth. Linear strips of R1 or R2 frequently occur between ridges. Fortunately, most dredger tailings are illustrated on the USGS 7.5 minute quadrangles and can be identified in that manner.

Gravel mining may be identified by the presence of vegetated or unvegetated ponds or pits (especially if these have an unnatural shape.)

i - intermittent

Intermittent is used to designate spottiness or non-consistent occurrence of a given vegetation type. When used with a single classification code symbol (or on both classification code symbols of a hybrid notation), the interspaced areas are interpreted as either S, W, and/or R3.

Category Hybrids

Where any habitat area cannot be classified clearly as one of the major categories (or subcategories), a "hybrid" of two codes was used. This was intended to allow for the most accurate representation of areas which have a mix of habitat types occurring in spaces too small to map individually. The hybrid system identified only the two most common habitat types, even though other types may be present.

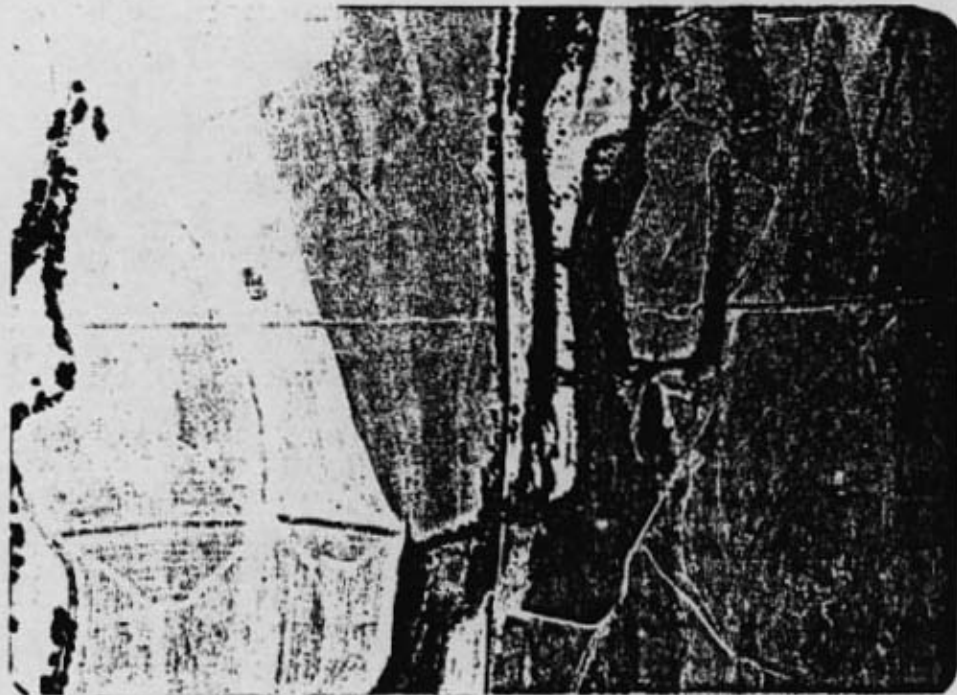
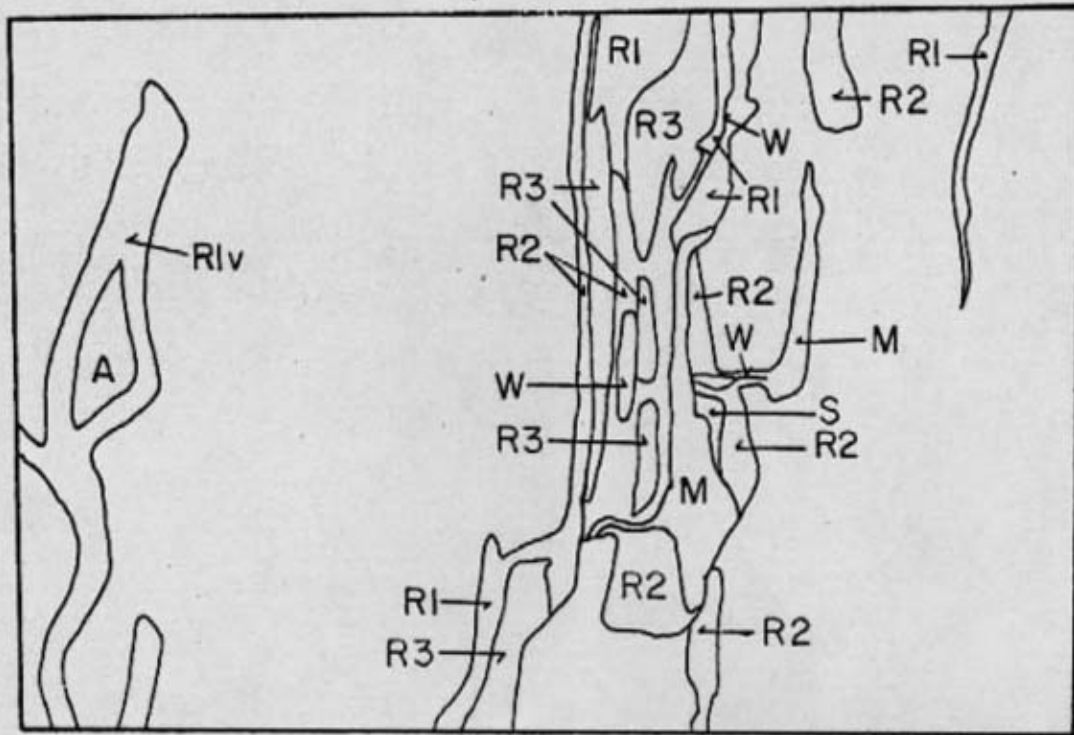
The hybrid code itself consists of classification codes from the two most prominent habitat types, separated by a slashed line. The first of the codes represents the habitat type which, on the basis of general appearance, seems to cover the greatest area. The other portion of the hybrid code represents that habitat type which covers the second-largest portion of the polygoned area. For example, an area composed of 45% R1, 35% R2, and 20% of any other habitat type was labeled R1/R2.

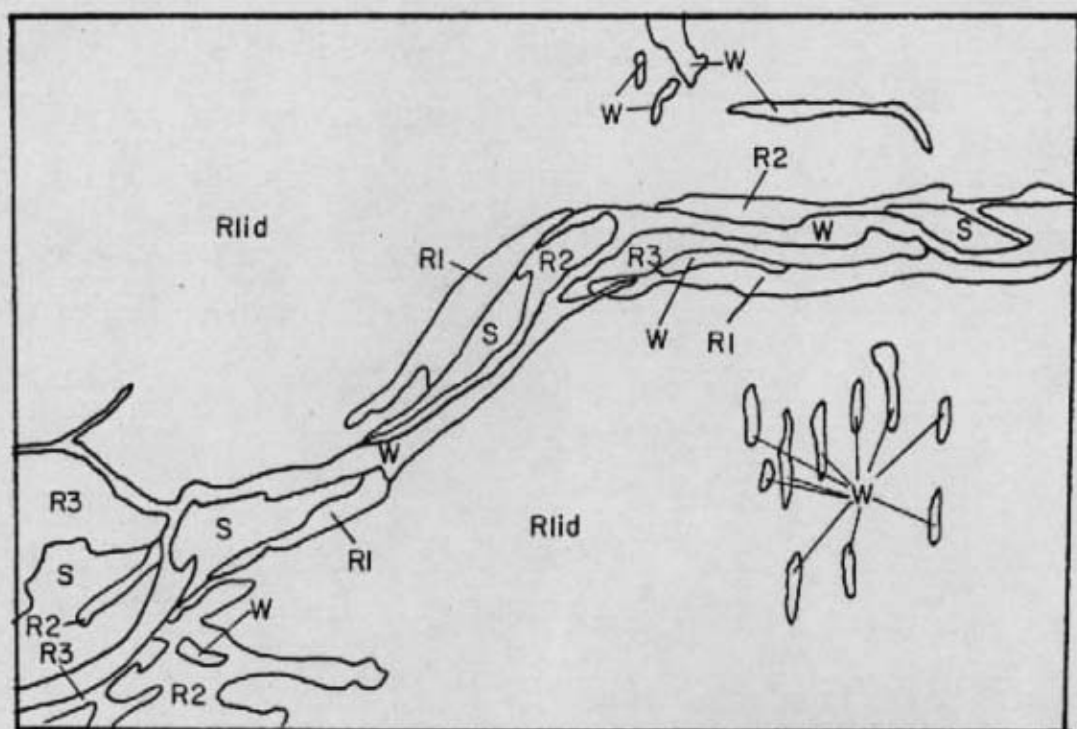
Where modifiers were needed, they were placed at the end of the hybrid code (e.g., R1/R2c indicates a canal which is lined with mixed R1 and R2 vegetation). Where a modifier is used, it refers to both portions of the hybrid symbol (e.g., R1/R2ic would indicate a channelized stream lined with intermittent mixed woody habitat).

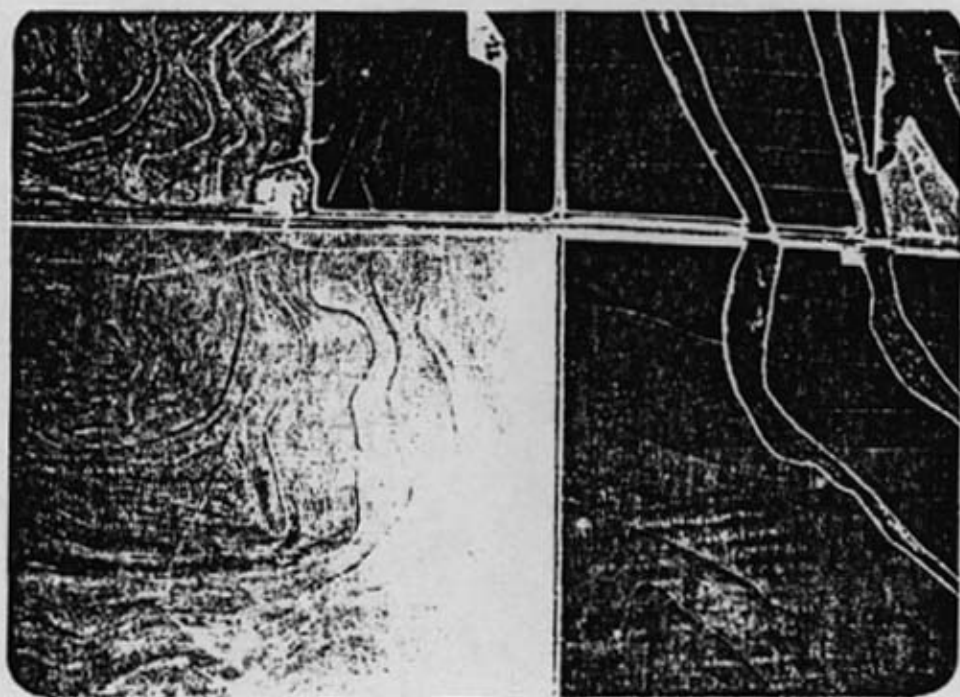
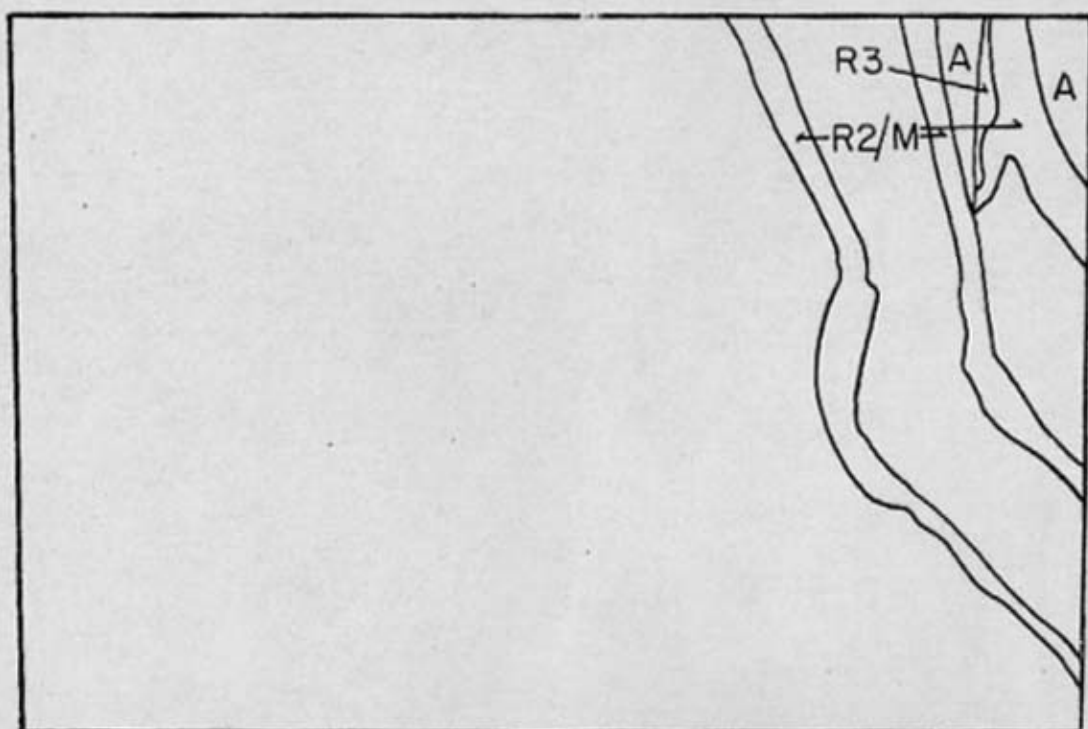
APPENDICES

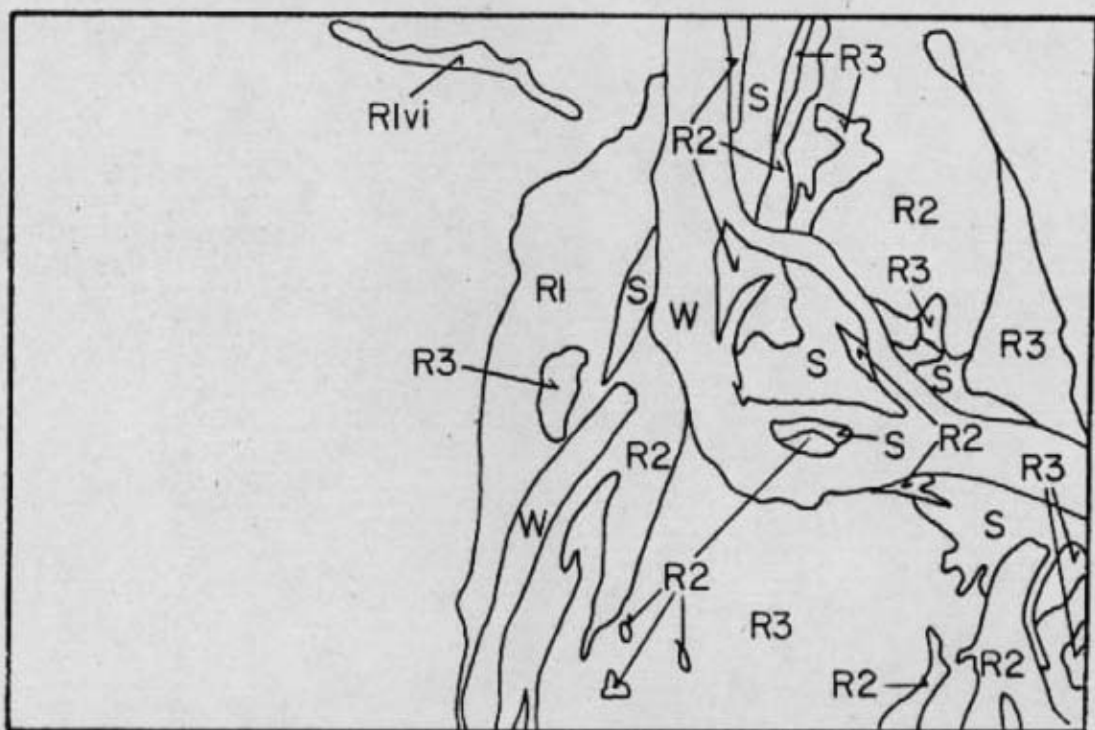
Appendix A.

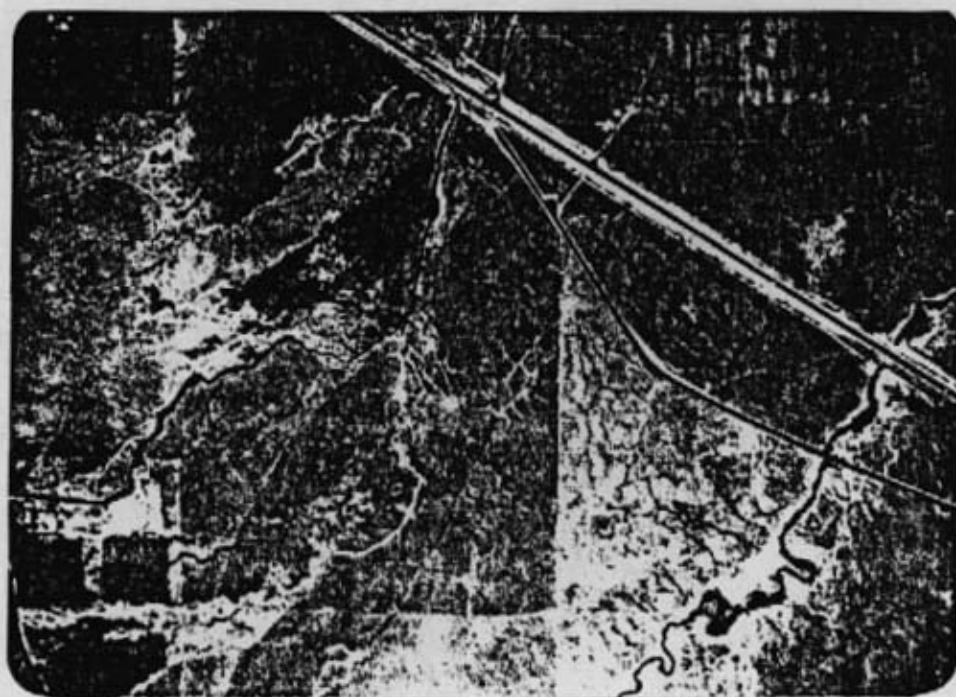
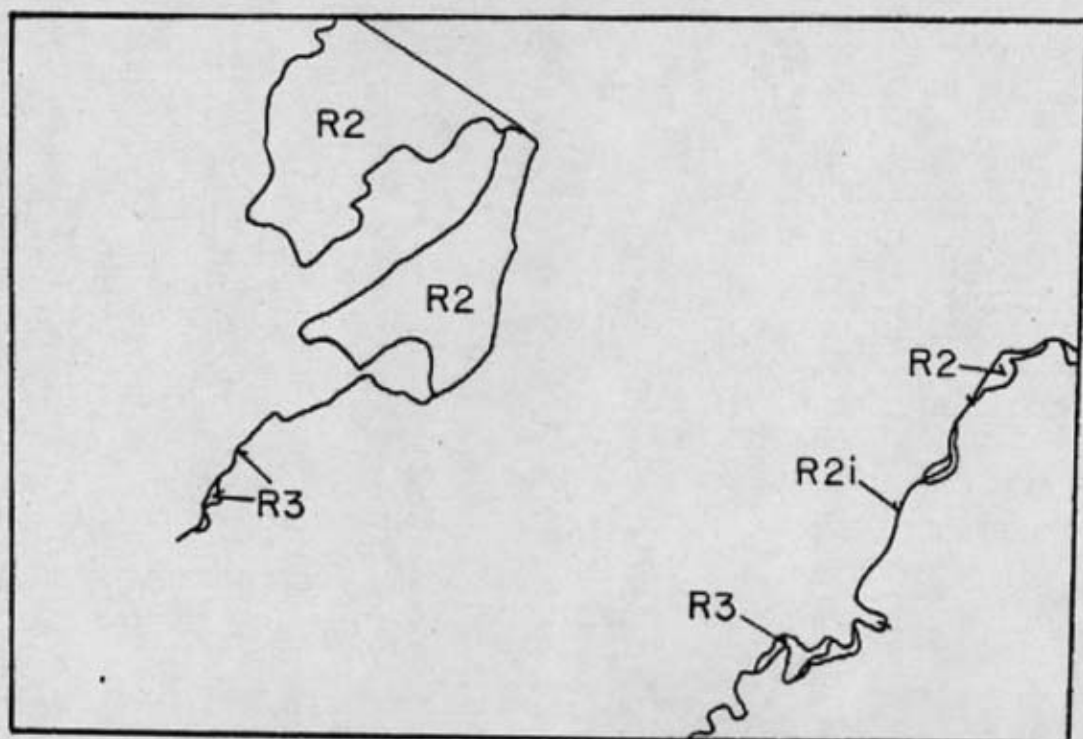
Examples: Mapping categories and modifiers.

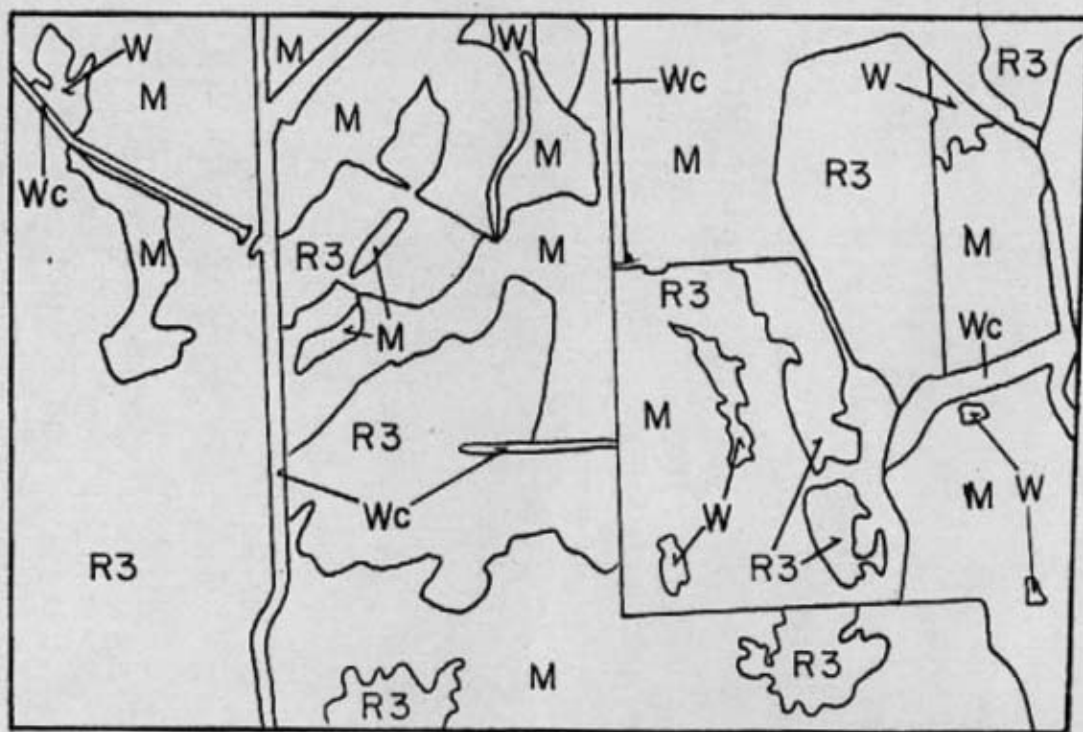


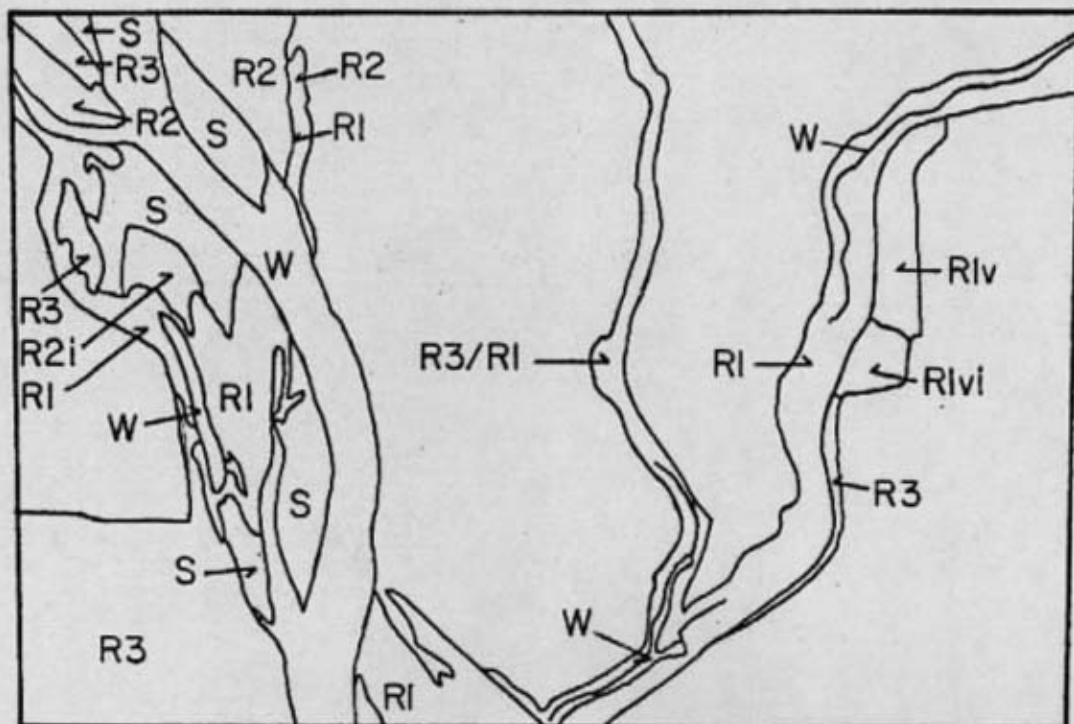












APPENDIX B

SUMMARY OF CLASSIFICATION CODES

R1 LARGE WOODY VEGETATION

DESCRIPTION: TALL MATURE FORESTS WITH SIGNIFICANT WOODY UNDERSTORY

SIGNATURE: MOTTLED LIGHT TO DARK GREEN; TREE CROWNS OFTEN DISCERNABLE

R1v VALLEY OAK WOODLAND SUBCATEGORY

DESCRIPTION: MATURE WELL-SPACED STANDS OF VALLEY OAKS WITHOUT WOODY UNDERSTORY

SIGNATURE: CONSISTENT DARK GREEN COLORATION; TREE CROWNS MAY BE WELL SEPARATED WITH GRASSLAND UNDERSTORY VISIBLE

R2 LOW WOODY VEGETATION

DESCRIPTION: LOW DENSE STANDS OF YOUNG TREES AND SHRUBS

SIGNATURE: SMOOTH TEXTURE; LIGHT GREEN OR GRAY-GREEN IN COLOR

R3 HERBACEOUS VEGETATION

DESCRIPTION: LOW HERBACEOUS GROWTH OCCURRING ALONG STREAM CHANNELS OR IN NATURAL CLEARINGS AMONG OTHER RIPARIAN TYPES

SIGNATURE: COLOR RANGES FROM BRIGHT GREEN TO BROWN, APPEARS AS CONSISTENTLY TEXTURED TREE-LESS VEGETATION

R3p PERENNIAL SEEPS SUBCATEGORY

DESCRIPTION: HERBACEOUS VEGETATION OCCURRING NEAR PERENNIAL SPRINGS AND SEEPS

SIGNATURE: GREEN IN COLOR, USUALLY SURROUNDED BY BROWN GRASSLANDS; WELL SEPARATED FROM STREAM CHANNELS

M MARSH

DESCRIPTION: HERBACEOUS EMERGENT VEGETATION OF PERENNIALY MOIST AREAS

SIGNATURE: MOTTLED OR CONSISTENTLY COLORED (AS IN CONCENTRIC RINGS) WITH VARIOUS SHADES OF GREEN AND BROWN; OPEN WATER AREAS ARE SOMETIMES EVIDENT

- S** **SAND AND GRAVEL BARS**
- DESCRIPTION: EXPOSED SAND, GRAVEL, OR ROCK AREAS
- SIGNATURE: CONSISTENTLY TEXTURED AREAS TYPICALLY WHITE, GRAY OR BROWN IN COLOR; ASSOCIATED WITH DEPOSITED OR DISTURBED AREAS
-
- W** **OPEN WATER**
- DESCRIPTION: STANDING OR MOVING WATERS
- SIGNATURE: COLOR VARIES FROM GREEN TO NEAR BLACK; REFLECTIONS, RIFFLES OR RAPIDS MAY APPEAR WHITE WHEN PRESENT
-
- A** **AGRICULTURAL LAND**
- DESCRIPTION: CULTIVATED LANDS WHICH ARE COMPLETELY OR NEARLY SURROUNDED BY RIPARIAN HABITAT TYPES
- SIGNATURE: DEVOID OF NATURAL VEGETATION; ORCHARDS, ROWCROPS, OR IRRIGATION FACILITIES ARE OFTEN VISIBLE
-
- U** **URBAN LAND**
- DESCRIPTION: BUILT-UP AREAS WHICH ARE NEARLY OR COMPLETELY SURROUNDED BY RIPARIAN HABITAT TYPES
- SIGNATURE: URBAN STRUCTURES OR DISTURBANCE IS EVIDENT

MODIFIERS

- C** **CHANNELIZED**
- DESCRIPTION: IRRIGATION CANALS AND HIGHLY CHANNELIZED STREAM COURSES WHICH HAVE BEEN SO ALTERED AS TO NO LONGER SHOW NATURAL STREAM CHARACTERISTICS
-
- D** **DISTURBED**
- DESCRIPTION: USED TO DESIGNATE AREAS WHICH CAN READILY BE IDENTIFIED AS HAVING BEEN SEVERELY ALTERED BY HUMAN ACTIVITIES
-
- I** **INTERMITTENT**
- DESCRIPTION: USED TO DESIGNATE SPOTTINESS OR NON-CONSISTENT OCCURRENCE OF ANY GIVEN HABITAT TYPE